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(54) MOBILE DIRECTIONAL ANTENNA WITH POLARIZATION SWITCHING

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H01Q 13/22 (2006.01)
H01Q 15/24 (2006.01)
H01Q 21/00 (2006.01)

(52) **U.S. Cl.**

CPC ***H01Q 3/24*** (2013.01); ***H01Q 13/22*** (2013.01); ***H01Q 15/244*** (2013.01); ***H01Q 21/005*** (2013.01)

(58) **Field of Classification Search**

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USPC 343/771; 342/361
See application file for complete search history.

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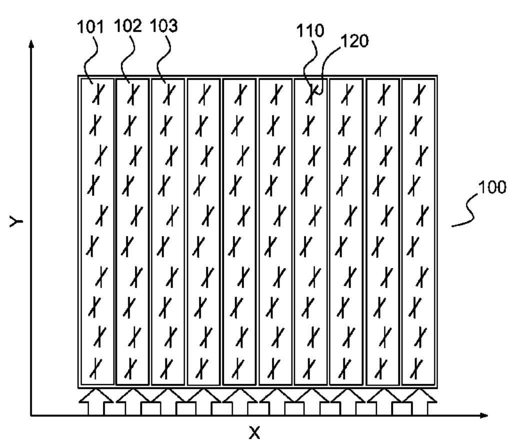
(57) **ABSTRACT**

An antenna with polarization switching comprising a plurality of waveguides fed with radiofrequency signals and perforated with apertures disposed so as to illuminate radiating elements placed on mobile support means in a plane that is distant from the said apertures, it being possible for the said support means to be configured according to at least two distinct configurations. The radiating elements illuminated according to one and the same configuration are adjacent, the support means being adapted for orienting the radiating elements illuminated in a first configuration according to a different direction from the radiating elements illuminated in a second configuration. The antenna applies notably to the switching of antennas onboard objects moving on the ground required to undertake high-speed communications with a satellite, in particular a geostationary satellite.

12 Claims, 11 Drawing Sheets



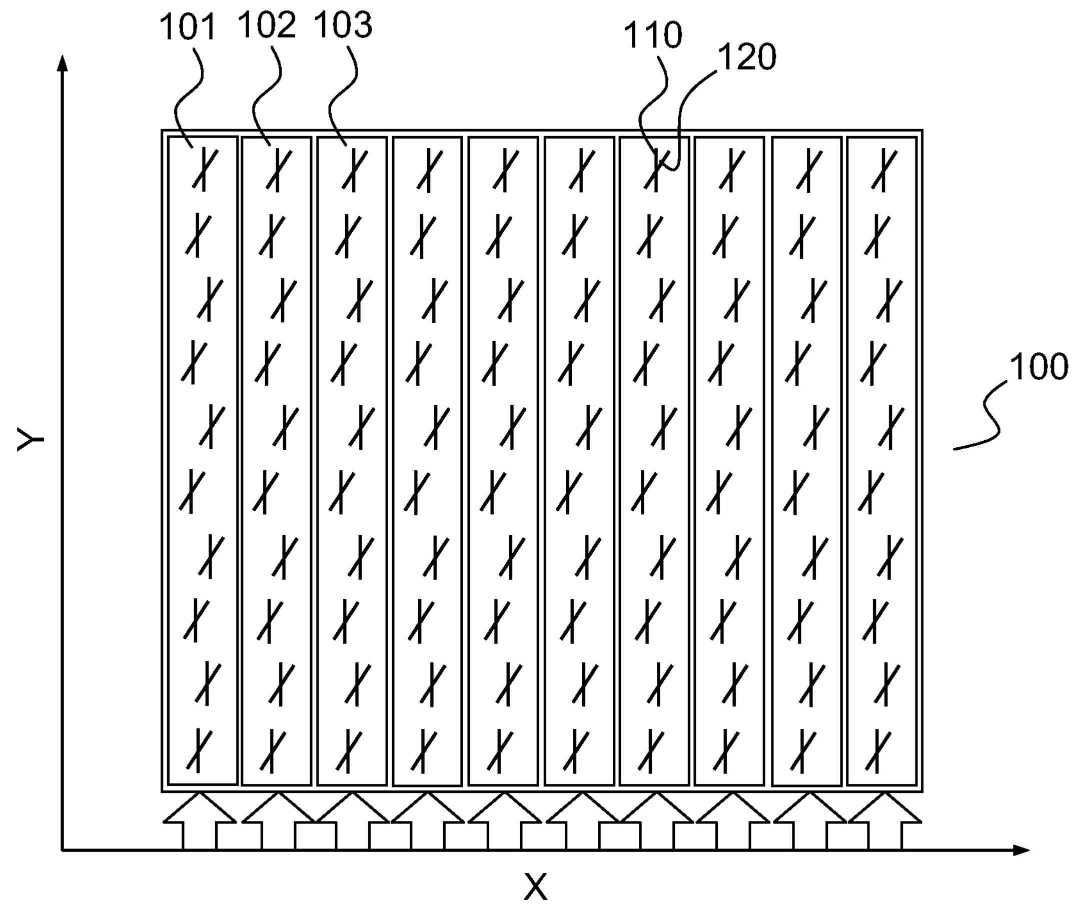


FIG.1a

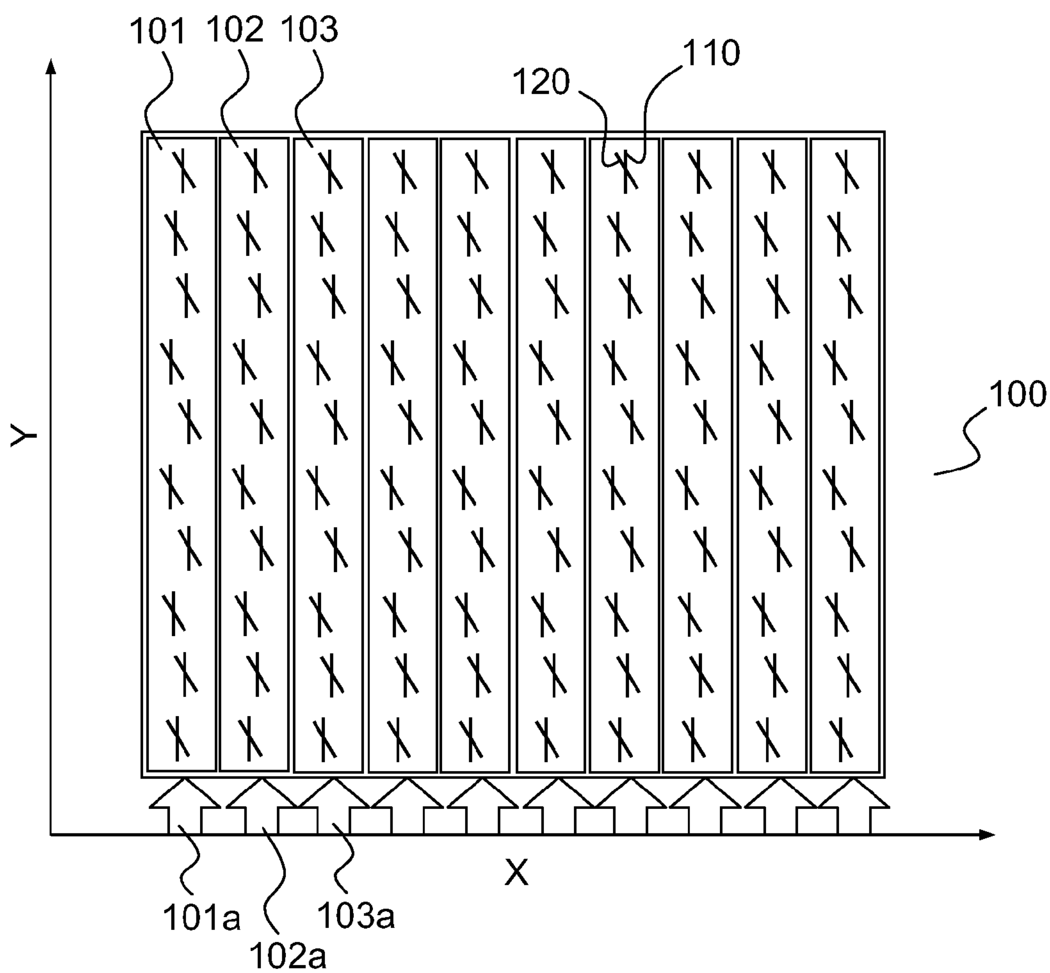
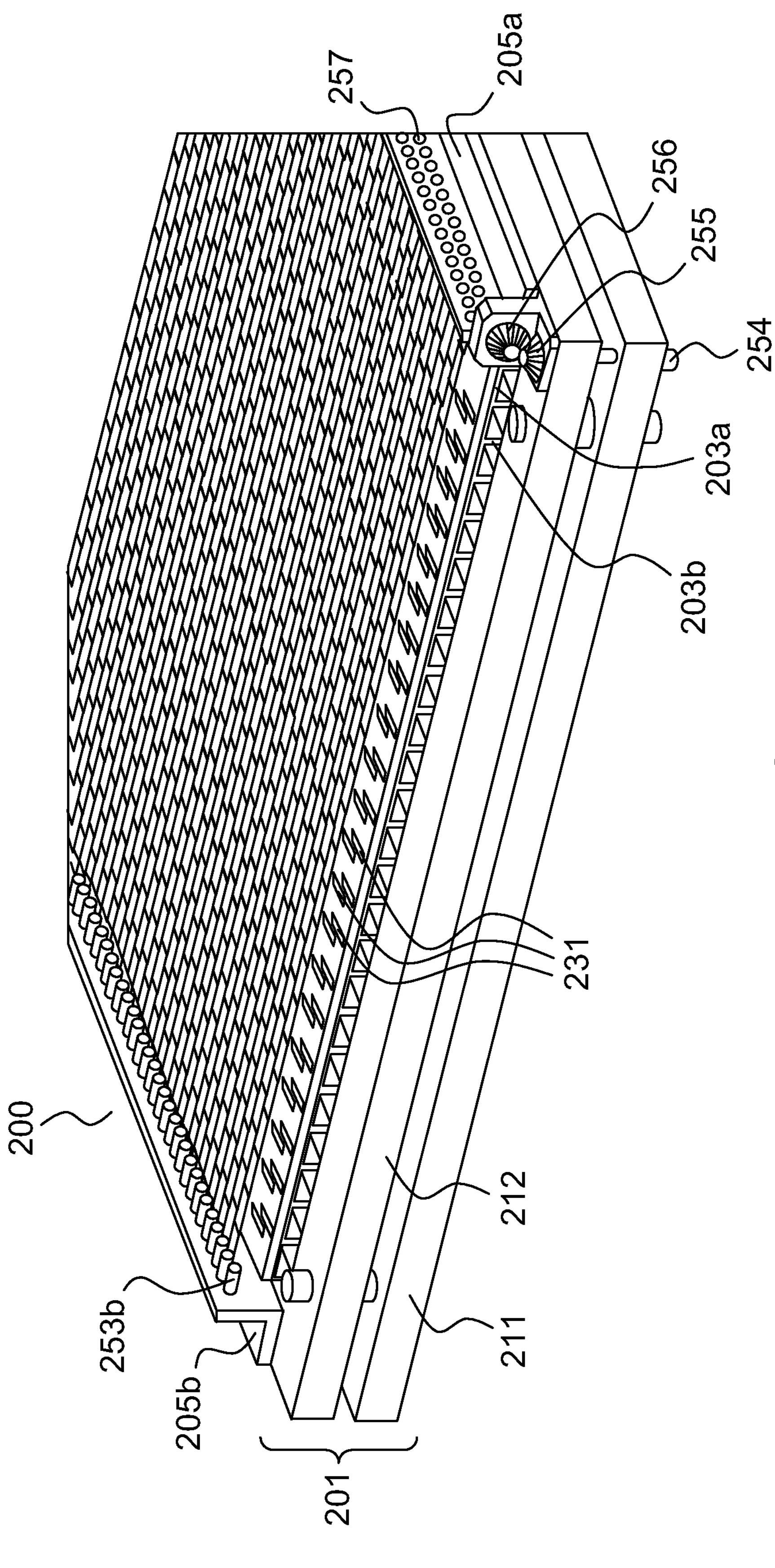


FIG.1b



257
205a
256
255
254
203a
203b
231
231
200
212
253b
205b
211
201

FIG.2a

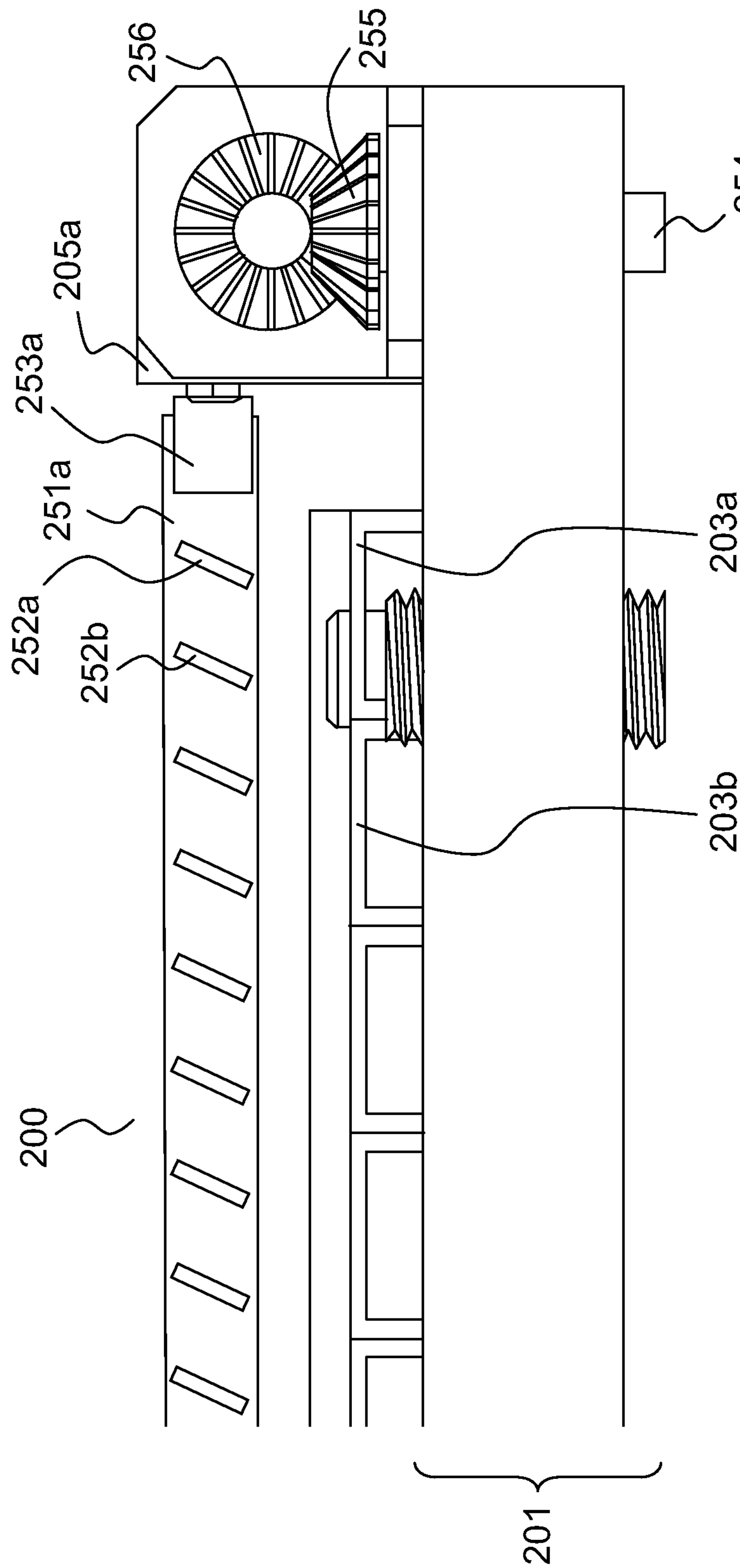


FIG.2b

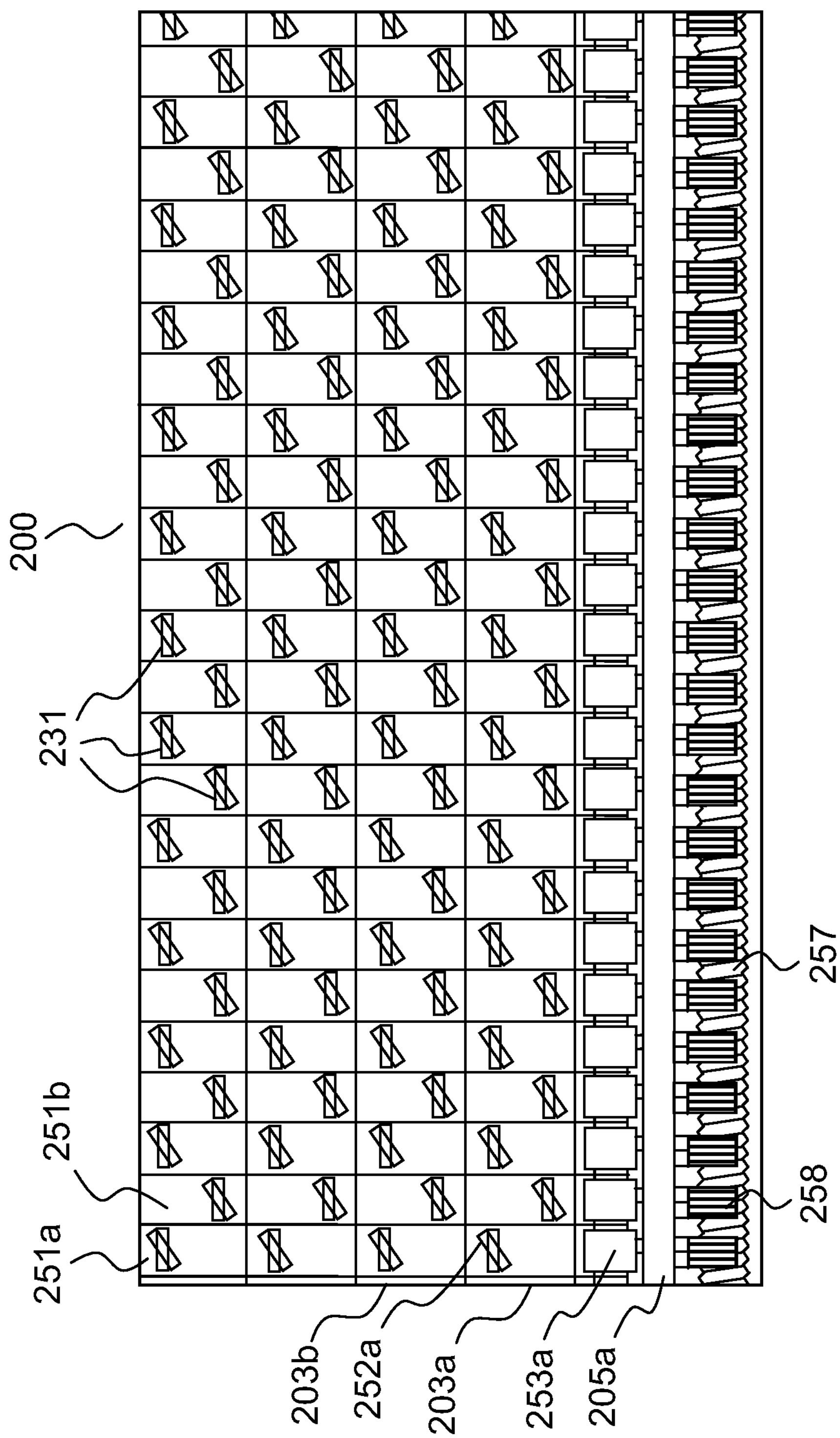


FIG.2c

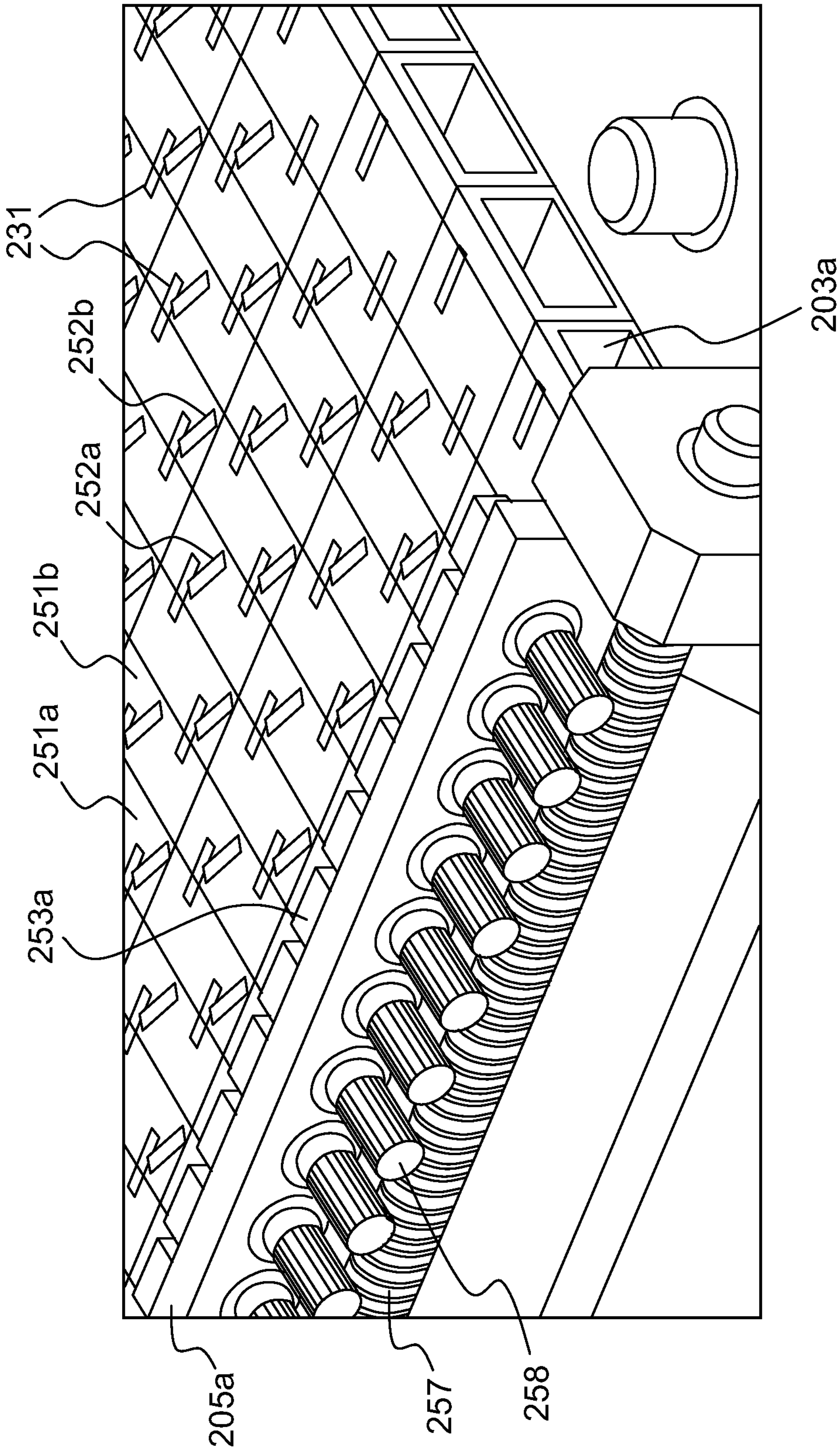


FIG.2d

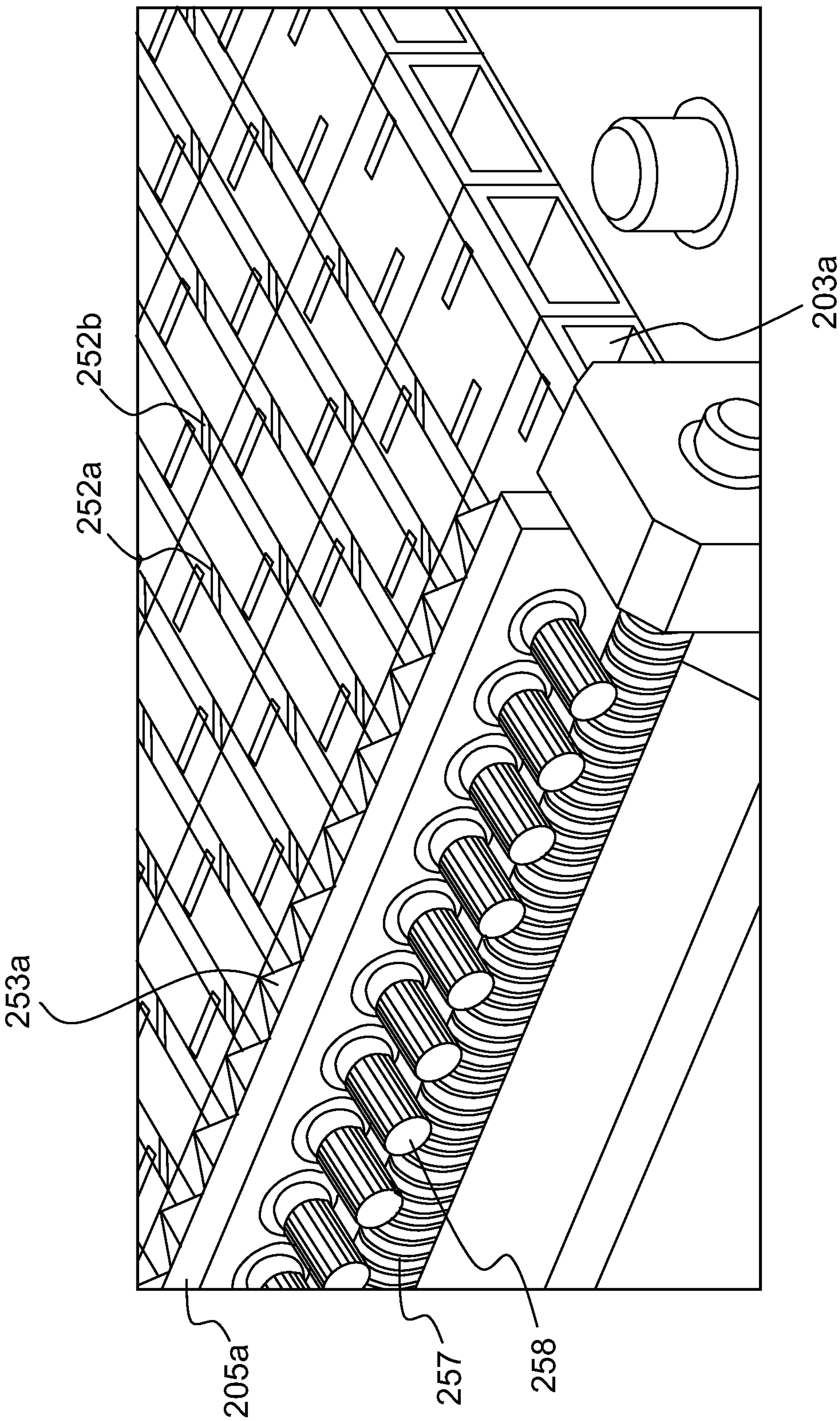


FIG.2e

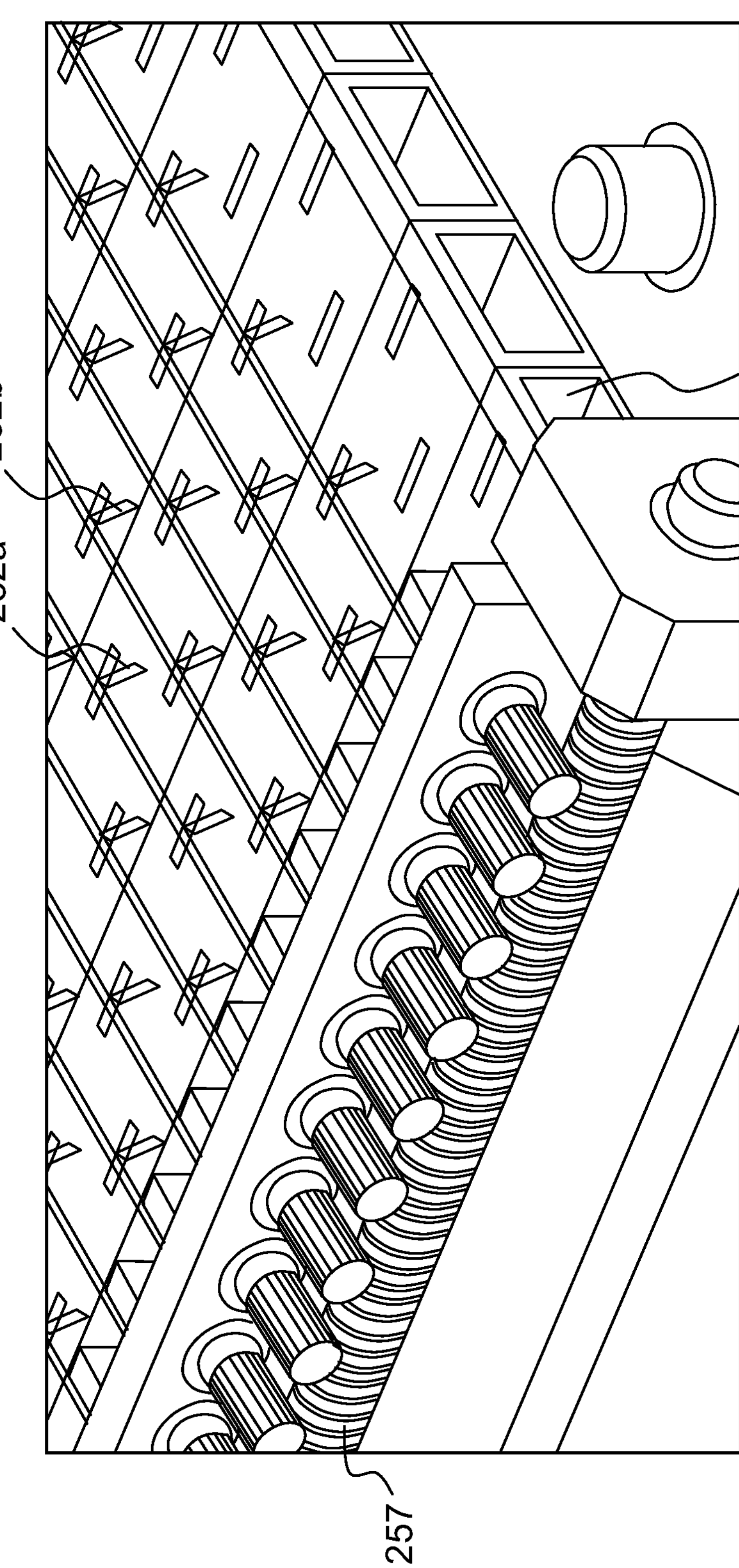


FIG.2f

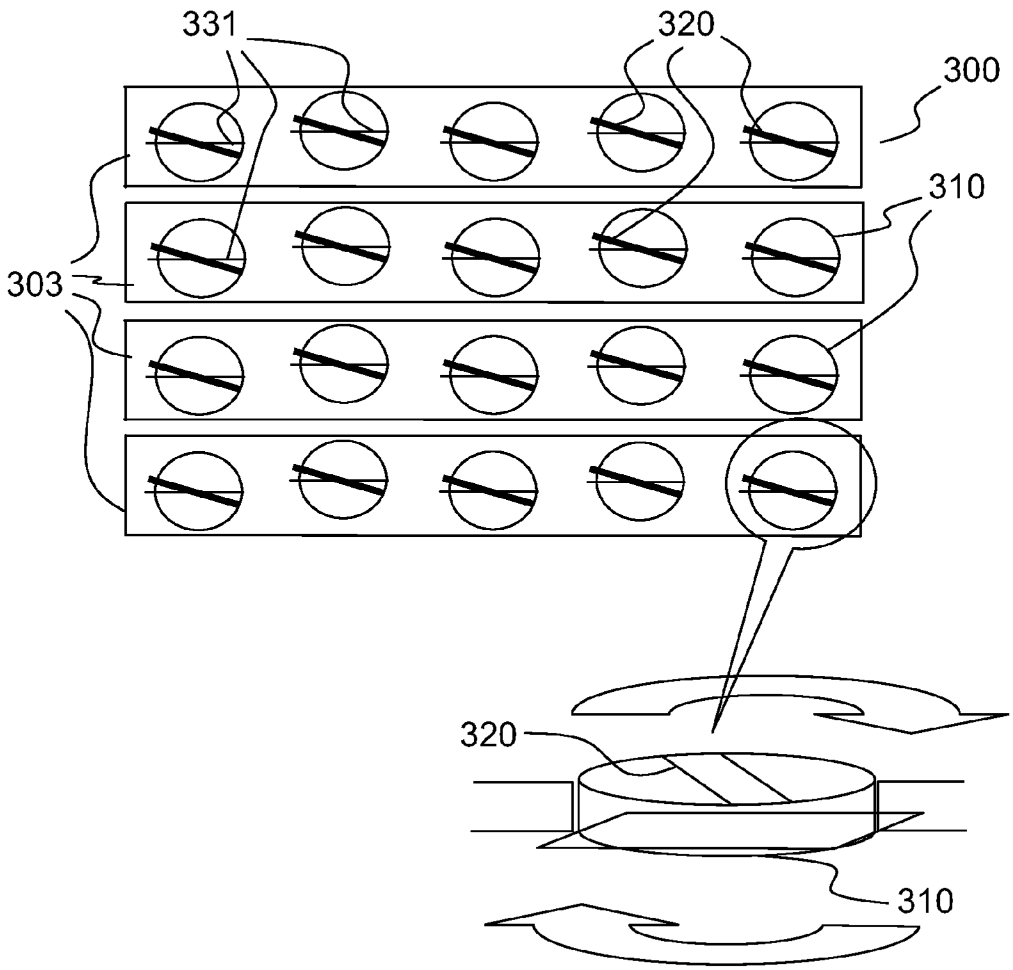


FIG.3a

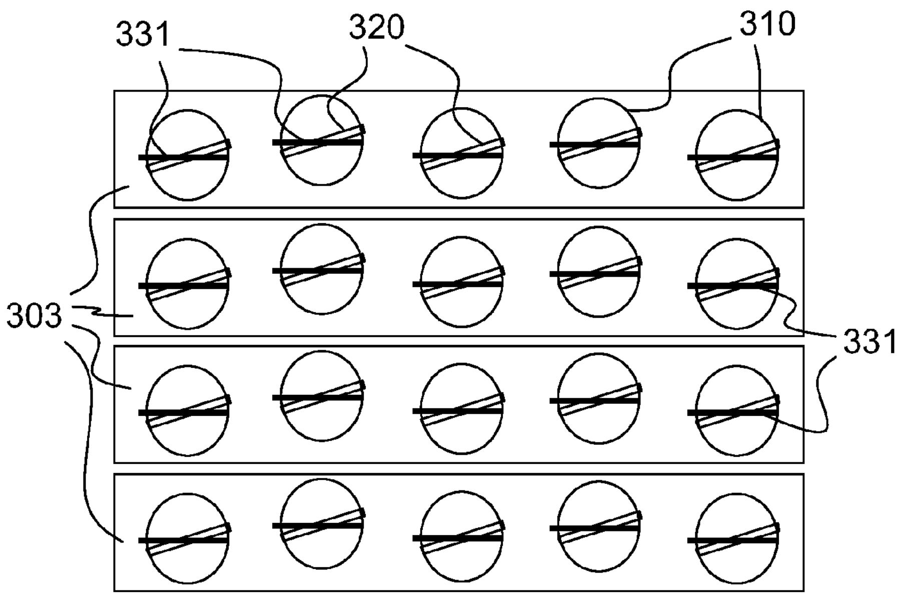


FIG.3b

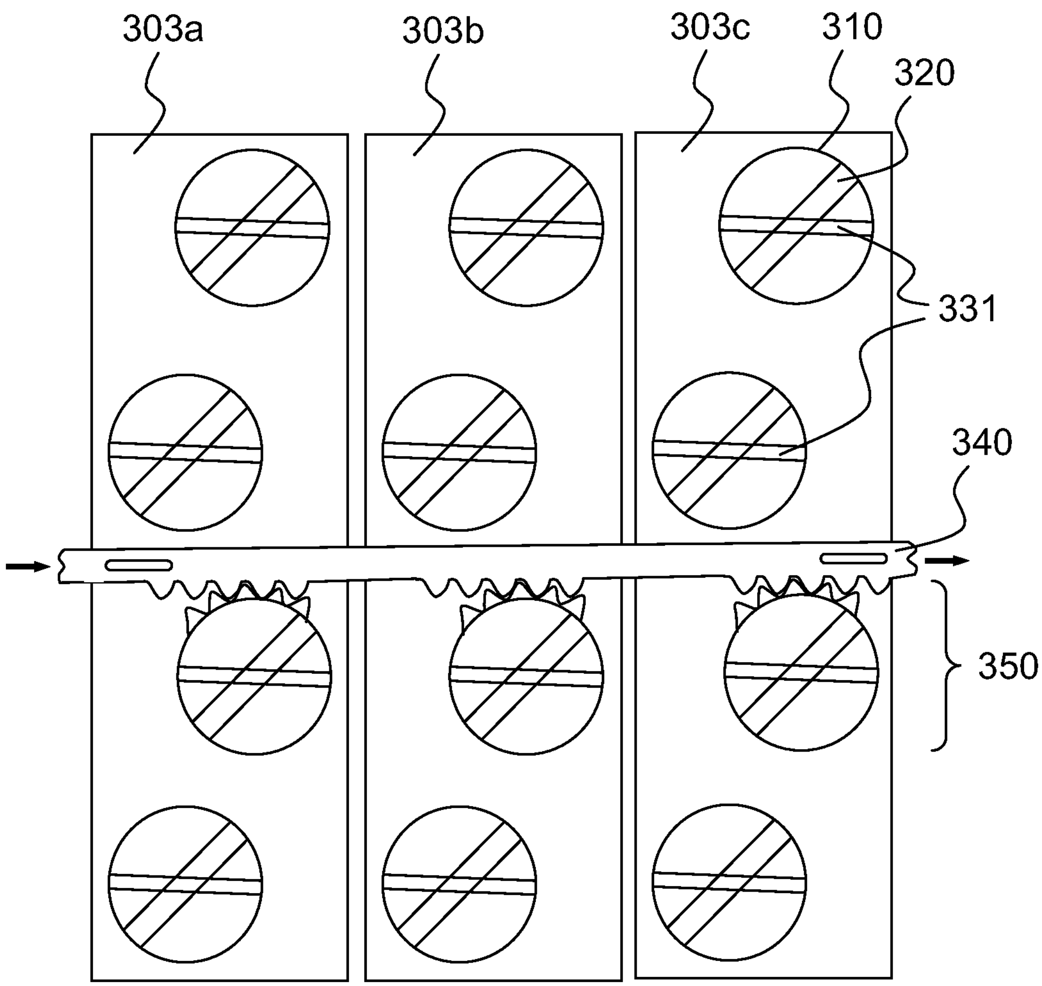


FIG.3c

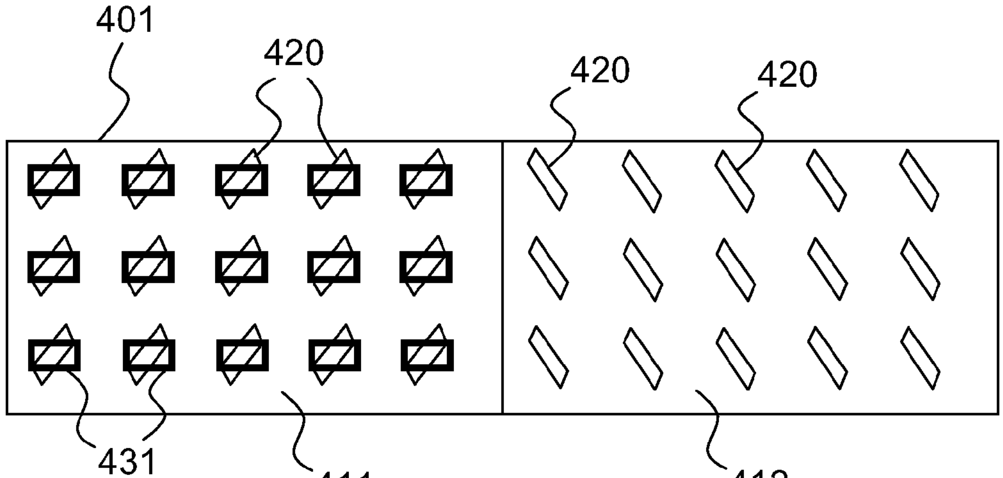


FIG.4a

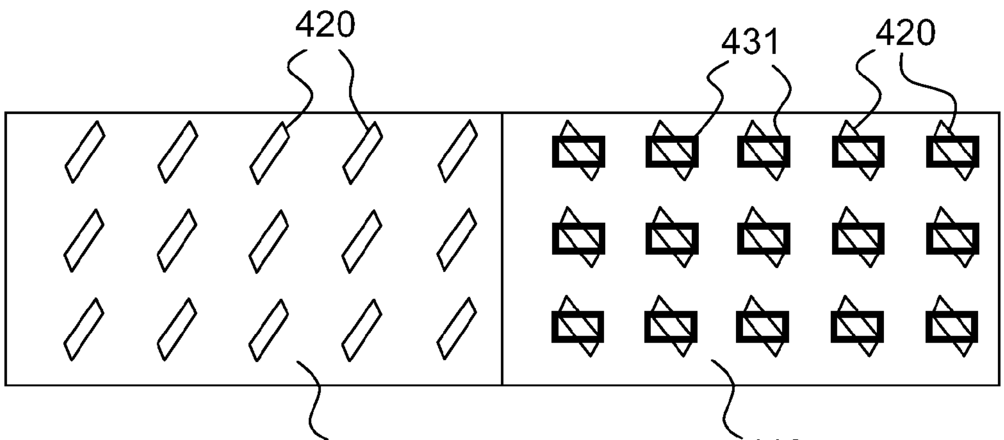


FIG.4b

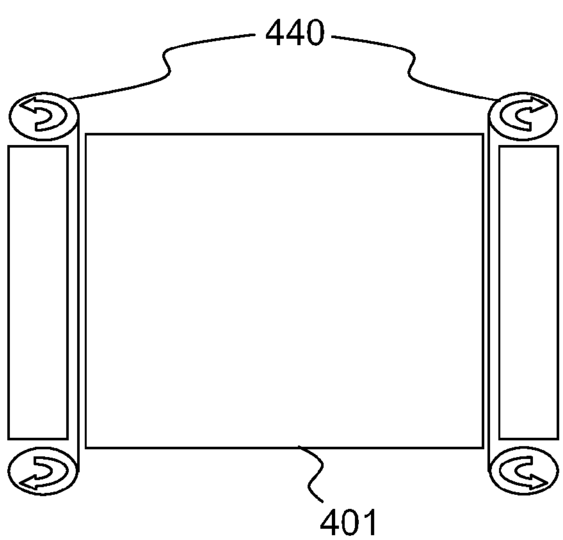


FIG.4c

MOBILE DIRECTIONAL ANTENNA WITH POLARIZATION SWITCHING

CROSS-REFERENCE TO RELATED APPLICATION

This application claims priority to foreign French patent application No. FR 1103536, filed on Nov. 21, 2011, the disclosure of which is incorporated by reference in its entirety.

FIELD OF THE INVENTION

The present invention relates to a mobile directional plane antenna with polarization switching. It applies notably to the switching of antennas onboard objects moving on the ground required to undertake high-speed communications with a satellite, in particular a geostationary satellite.

BACKGROUND

In order to provide for communications between a fixed point, for example a geostationary satellite, and a moving point, for example a vehicle on the ground, an antenna making it possible to hunt down the fixed point is disposed at the level of the moving object. The constraints to be adhered to by this antenna are severe. Notably, it must be configured so as not to emit in other directions signals with a power density greater than a regulated level, so as not to disturb the service provided for by adjacent satellites. A relatively high precision in the tracking of the satellite must therefore be guaranteed with this type of antenna. By way of example, for coverage of the European continent, the reflector of an antenna on the ground (or on an airborne carrier) must be able to be oriented in relation to an interval of angles lying between about 10° in elevation for Spain and 60° for northern Europe, the reflector being 360° orientable in relation to the azimuth angle. The reflector, with a diameter of about 60 to 70 cm, must thus benefit from a considerable freedom of movements and from a reliable and precise control system, thus leading to bulky and expensive antennas. Moreover, when the polarization of the signals is linear—if for example the satellite comprises an antenna with a single source of signals—, the ground antenna must be constantly aligned with the direction of polarization.

In order to lessen the constraints to be satisfied by ground antennas and thus simplify their production, circular polarization may be employed in place of the aforementioned linear polarization, for example in the Ka band. By way of illustration, the frequency band lying between 19.7 GHz and 20.2 GHz can serve in reception at the satellite level, while the band lying between 29.5 GHz and 30 GHz may be used in emission, coverage being provided for by a set of adjacent spots in right or left circular circulation.

Multibeam satellites cover a territory with a plurality of spots configured in such a way that the signals emitted on two neighbouring spots do not interfere. In addition, the coverage of a satellite comprises spots having various transmission frequencies and/or various polarizations, two neighbouring spots being configured so as not to have, at one and the same time, the same polarization and the same transmission frequency. The frequency characteristics and polarization characteristics of the signals emitted on a spot are generally designated by the expression “spot colour”, two neighbouring spots therefore having distinct colours. By way of illustration, with two different polarizations and two different transmission frequencies, four colours of spots may be created.

Antennas onboard mobile craft required to provide for communication with a satellite sometimes cross a boundary between two spots. This is the case, for example, with antennas intended to provide an Internet connection from an aircraft or a train. When the antenna leaves the zone covered by a first spot configured with a first polarization (for example right circular) and enters the zone covered by a second spot configured with a second polarization (left circular), the antenna must switch rapidly so as to modify its emission and/or reception polarization. Furthermore, the radiating elements of a beamforming antenna must be sufficiently close together to avoid the formation of lateral radiation lobes, liable to perturb adjacent communication systems.

A publication by Kwang-Seop Son et al., published in 2006 in “Proceedings of Asia-Pacific Microwave conference” under the title “Waveguide Slot Array In-Motion Antenna for Receiving both RHCP and LHCP using Single Layer Polarizer”, discloses an antenna structure comprising sources of signals exciting polarizers aligned on a film. The polarizers are arranged alternately in opposite directions and the sources are separated from the film of polarizers by a radiofrequency-insulating layer and provided with a series of cavities placed facing the polarizers in such a way that at a given instant, one polarizer out of two is illuminated by a source. The film may be actuated in translation so that the cavities are placed facing the polarizers which were not previously illuminated. These polarizers being oriented in a different direction from the first polarizers, the polarization of the signals emitted by the antenna is reversed. This antenna therefore makes it possible to carry out a switching between two different polarizations. However, it comprises drawbacks. Indeed, its structure imposes a relatively large distance between the radiating elements, thereby giving rise to overly sizable lateral lobes in the radiation pattern.

SUMMARY OF THE INVENTION

An aim of the invention is to propose a directional and compact electronic beamforming antenna able to switch its polarization. For this purpose, the subject of the invention is an antenna with polarization switching comprising a plurality of waveguides fed with radiofrequency signals and perforated with apertures disposed so as to illuminate radiating elements placed on mobile support means in a plane that is distant from the said apertures, it being possible for the said support means to be configured according to at least two distinct configurations, wherein the radiating elements illuminated according to one and the same configuration are adjacent, the support means being adapted for orienting the radiating elements illuminated in a first configuration according to a different direction from the radiating elements illuminated in a second configuration. The radiating elements may have a linear shape. The antenna according to the invention does not impose any distance between the radiating slots, thereby making it possible to adhere to the criterion for rejecting the array lobes outside of a scan zone, even for a scan of +/−40°.

According to one embodiment of the antenna with polarization switching according to the invention, the radiating elements illuminated according to the first configuration and the radiating elements illuminated according to the second configuration are the same, the support means being adapted for modifying their orientation with respect to the apertures. Thus, only one radiating element is needed per aperture and each of the radiating elements is illuminated through the same aperture regardless of the configuration.

According to one embodiment of the antenna with polarization switching according to the invention, the waveguides are rectangular cross-section guides, the apertures being distributed, for each of the waveguides, on a face of the said waveguide alternately on either side of its longitudinal mid-axis. Thanks to the use of hollow waveguides, the antenna has lower losses; ohmic efficiency is the highest possible.

According to one embodiment of the antenna with polarization switching according to the invention, the apertures are slots. The antenna is more robust than other flat antennas, such as microstrip patches.

According to one embodiment of the antenna with polarization switching according to the invention, the slots are parallel to the longitudinal axis of the waveguides. This embodiment allows space saving.

According to one embodiment of the antenna with polarization switching according to the invention, the radiating elements are dipoles. The dipoles can for example be formed of a rectilinear metal component.

According to one embodiment of the antenna with polarization switching according to the invention, the radiating elements are placed above the apertures at a height comprised between a fifth and a quarter of the wavelength of the radiofrequency signals travelling in the waveguides.

According to one embodiment of the antenna with polarization switching according to the invention, the support means of the radiating elements are constructed of a material which is transparent to radiofrequency waves.

According to one embodiment of the antenna with polarization switching according to the invention, the support means of the radiating elements comprise several parallel strips maintained above the apertures, it being possible for the said strips to be arranged according to two configurations, the said strips being able to invert so as to place a first face of the strips facing the apertures in the first configuration, and the opposite face of the said strips facing the apertures in the second configuration.

According to one embodiment of the antenna with polarization switching according to the invention, the radiating elements form a nonzero and non-orthogonal angle with the longitudinal axis of the strips, the strips being able to rotate about the said longitudinal axis in order to invert.

According to one embodiment of the antenna with polarization switching according to the invention, the support means of the radiating elements comprise pivoting elements aligned according to several rows, the said support means comprising, for each of the said rows, a rod adjoining the pivoting elements of the said row, the said rod and the said pivoting elements being configured in such a way that a translational motion of the said rod drives the said pivoting elements in rotation. The rod can for example be a rack, the pivoting elements being cylinders comprising striations on their edge so as to be able to be driven by the said rack. Thus, only one radiating element per aperture is needed and each of the radiating elements is illuminated through the same aperture regardless of the configuration.

According to one embodiment of the antenna with polarization switching according to the invention, the support means of the radiating elements comprise rollers and a flexible band arranged so as to be able to wind up around the said rollers, the flexible band comprising a first part on which are fixed adjacent radiating elements oriented in a first direction, and a second part on which are fixed adjacent radiating elements oriented in a different direction from the said first direction.

BRIEF DESCRIPTION OF THE DRAWINGS

Other characteristics will become apparent on reading the following nonlimiting detailed description given by way of example and in relation to appended drawings which represent:

FIGS. **1***a* and **1***b*, a basic diagram illustrating the antenna according to the invention;

FIG. **2***a*, a first embodiment of the antenna according to the invention, viewed in perspective;

FIG. **2***b*, the first embodiment of the antenna according to the invention, viewed from the side;

FIG. **2***c*, the first embodiment of the antenna according to the invention, viewed from above;

FIGS. **2***d*, **2***e*, and **2***f*, illustrations of the switching phase of the first embodiment of the antenna according to the invention, viewed in perspective;

FIGS. **3***a*, **3***b* and **3***c*, a second embodiment of the antenna according to the invention;

FIGS. **4***a*, **4***b* and **4***c*, a third embodiment of the antenna according to the invention.

DETAILED DESCRIPTION

FIGS. **1***a* and **1***b* illustrate by basic diagrams the antenna according to the invention. The antenna **100** is viewed from above. Each of the waveguides **101**, **102**, **103** is fed with radiofrequency signals **101***a*, **102***a* **103***a* and extends parallel to the Y axis. The waveguides may be guides with rectangular cross-section. Each waveguide **101**, **102**, **103** is regularly drilled with apertures **110** in the form of rectangular slots preferably parallel to the waveguide, so as to reduce the dimensions of the antenna. By way of example, the antenna occupies an area of about 6 cm×6 cm.

A radiating element **120** in the form of a dipole is placed above each aperture **110**, in a plane parallel to the plane in which the apertures **110** are made. The plane in which the dipoles are placed is advantageously situated at a distance equal to a value chosen between a fifth and a quarter of the wavelength of the signals transmitted in the waveguides, in order to produce such a perturbation on the field coming from the aperture so that two orthogonal field components, equal in magnitude and out of phase by 90 degrees, i.e. circularly polarized field, are obtained. The choice of the distance causes a phase difference of 90 degrees. The dipoles **120** form, viewed from above, a nonzero and non-perpendicular angle with the apertures **110** formed in the waveguide **101**, **102**, **103**.

The antenna according to the invention can take at least two configurations. FIG. **1***a* illustrates a first configuration of the antenna in which a first angle is formed between each of the apertures **110** and the dipoles **120**, this angle being equal, for example to 45°. That first angle can theoretically take any value between 0° and 90° strictly excluding 0° and 90°. The angle chosen may result from an analysis taking into account lengths and widths of both, slot and dipole, along with the selected distance between them and the permittivity of the media around. FIG. **1***b* illustrates a second configuration of the antenna in which the angle formed between the apertures **110** and the dipoles **120** is equal to the opposite of the first angle. Stated otherwise, the dipoles **120** placed above the apertures **110** in the second configuration of the antenna **100** (FIG. **1***b*) form, with the dipoles **120** placed above the apertures **110** in the first configuration (FIG. **1***a*), an angle equal to twice the angle formed between the dipoles **120** of the first configuration and the apertures **110**.

FIGS. **2***a*, **2***b* and **2***c* present a first embodiment of the antenna according to the invention, viewed respectively in perspective, from the side and from above. The antenna **200** comprises support means **201** on which are disposed waveguides **203***a*, **203***b* and two brackets **205***a*, **205***b* supporting a plurality of rigid strips **251***a*, **251***b* above the waveguides **203***a*, **203***b*.

The waveguides **203***a*, **203***b* extend parallel to one another. They may be fed with signals from an end. In the example, these waveguides **203***a*, **203***b* are of rectangular cross-section. They are drilled in their upper part, so as to form slots **231**. Advantageously, the slots are oriented parallel to one another and in the longitudinal direction of the waveguides **203***a*, **203***b*. In the example, the slots are placed identically from one waveguide **203***a* to the other **203***b*. Moreover, in each waveguide **203***a*, **203***b*, the slots **231** are preferably placed alternately on either side of the longitudinal mid-axis **233** of the waveguide in order to make the slots radiate in phase, so as to form a regular grid of slots **231** over the whole area of the antenna **200**.

The brackets **205***a*, **205***b* are placed facing one another, on two opposite edges of the support means **201**, parallel to the waveguides **203***a*, **203***b*. Holding elements **253***a*, **253***b* for strips are mounted in pairs on each of the brackets, a first holding element being mounted on the first bracket **205***a*, a second holding element being mounted on the second bracket **205***b*, the two elements facing one another so as to hold the strips **251***a*, **251***b* at a predetermined distance above the waveguides **203***a*, **203***b*, the strips extending in a direction perpendicular to the waveguides. The holding elements **253***a*, **253***b* are mounted so that they are able to rotate about an axis joining two holding elements **253***a*, **253***b* of one and the same pair, that is to say by two holding elements supporting one and the same strip **251***a*. The holding elements **253***a*, **253***b* of one and the same pair can thus rotate in a coordinated manner so as to drive the strip that they hold in rotation about the longitudinal axis of the strip **251***a*. In the example, the first holding element **253***a* of a pair is driven by controlled rotation means, the second holding element **253***b* is simply in free rotation about an axis and driven under the effect of a rotation of the strip **251***a*. The controlled rotation means can comprise a set of two bevel gears **255**, **256** making it possible to transform a rotational motion about an axis orthogonal to the plane of the antenna **200** into a rotational motion about an axis parallel to the brackets **205***a*. The first gear **255** is for example secured to a rod **254** driven in rotation by a motor (not represented in the figure). The second gear **256** drives an endless screw **257** adjoining the holding elements **253***a*, **253***b*, thus making it possible to transmit the rotational motion to them, these holding elements comprising a striated projecting part **258** protruding from the rear of the bracket **205***b*.

Dipoles **252***a*, **252***b* are disposed on the strips **251***a*, **251***b* so as to be positioned above the slots **231** formed in the waveguides **203***a*, **203***b*. The strips **251***a*, **251***b* are transparent to radiofrequency signals so as not to disturb the radiating effect of the dipoles **252***a*, **252***b*.

The support means **201** comprise a lower part **211** and an upper part **212**, which is mounted so as to move along an axis orthogonal to the plane formed by the support means **201**. In the example, the lower part **211** and the upper part **212** are material plates which are able to move away from or towards one another by virtue of sliding means, comprising for example rods **254**, rams, endless screws, or any other means making it possible to vary the distance between the two parts **211**, **212**. The upper part **212** maintains a constant distance with the brackets **205***a*, **205***b* and the strips **251***a*, **251***b*, the brackets **205***a*, **205***b* being fixed to this upper part **212**. The lower part **211** maintains a constant distance with the waveguides **203***a*, **203***b*, the waveguides **203***a*, **203***b* being fixed to uprights **214** secured to this lower part **211**. Thus when the two parts **211**, **212** move away from one another, the brackets **205***a*, **205***b* and the strips **251***a*, **251***b* move away from the waveguides **203***a*, **203***b*.

During normal operation of the antenna **200**, the lower part **211** and the upper part **212** are adjoining. The distance between the slots **231** and the strips **251***a*, **251***b* is chosen so that the radiofrequency signals travelling through the slots **231** excite the dipoles and thus make it possible to create an array of radiating elements according to a given polarization.

When a rotation of the strips **251***a*, **251***b* has to be performed, the upper part **212** is moved away from the lower part **211**, so as not to damage the strips **251***a*, **251***b* and/or the holding elements **253***a*, **253***b* during the rotation, by avoiding a collision of these elements with the waveguides **203***a*, **203***b*. In addition, when the polarization of the antenna has to switch, the upper part **212** detaches from the lower part **211** so as to let the rotation of the strips **251***a*, **251***b* proceed without damage, before the two parts **211**, **212** are moved back together again once the rotation has been performed—this moving back together can be effected progressively once the rotation by a quarter of a turn has been performed.

FIGS. **2***d*, **2***e*, and **2***f* illustrate the switching phase of the first embodiment of the antenna according to the invention, viewed in perspective. According to a first configuration of the antenna **200**, illustrated in FIG. **2***d*, the strips **251***a*, **251***b* are held in the horizontal position, all the dipoles **252***a*, **252***b* being oriented in a given direction.

When a switching of the antenna **200** is performed, the upper part **212** of the support means is displaced so as to move it away from the lower part **211**. Once the strips **251***a*, **251***b* are sufficiently distant from the waveguides **203***a*, **203***b*, the rod **254** is set into rotation. This rod **254** causes the rotation of the first bevel gear **255**, which transmits the rotational motion to the second bevel gear **256**, which provides for the rotation of the endless screw **257** so as to rotate the holding elements **253***a* fixed to the bracket **205***a*, and consequently the strips **251***a*, and the holding elements **253***b* fixed to the opposite bracket **205***b*. FIG. **2***e* illustrates the first embodiment of the antenna when the rotation of the strips **251***a*, **251***b* is in progress. The strips **251***a*, **251***b* are in the process of inverting. The rotation is activated until the upper face of the strips **251***a*, **251***b* replaces the lower face. Advantageously, the dipoles **252***a*, **252***b* are centred on the axis of rotation of the strip on which they are fixed, in such a way that their position in the first configuration is symmetric with their position in the second configuration. Once the rotation has been accomplished, the antenna **200** is situated in the second configuration, illustrated by FIG. **2***f*. The orientation of the dipoles **252***a*, **252***b* is then modified since their position undergoes a transformation with respect to the axis of symmetry formed by the axis of rotation of the strip **251***a*, **251***b*. On account of the change of position of the dipoles with respect to the slots above which they are situated, the polarization of the signals transmitted by the antenna is reversed. Thus, in the case of circularly polarized signals, the passage from one configuration to the other of the antenna makes it possible to pass from a left circular circulation to a right circular circulation.

In contradistinction to certain antennas known in the prior art, no element is inserted between the dipoles, whatever the configuration of the antenna, thereby making it possible to reduce the spacing between the dipoles. The arrangement of the slots and dipoles thus makes it possible to obtain an antenna comprising a high density of radiating elements, while having the capability of switching its polarization.

FIGS. **3***a*, **3***b* and **3***c* present a second embodiment of the antenna according to the invention. The antenna **300** comprises mutually parallel waveguides **303**. Slots **331** are formed in the upper part of the waveguides, similarly to those of the first embodiment presented in FIG. **2***a*. A pivoting support **310**, for example such as illustrated by the detail of

FIG. **3***a*, able to rotate about an axis orthogonal to the plane of the antenna **300** is disposed on each slot **331**. A dipole **320** is fixed to each of the pivoting supports **310**, so as to be illuminated by the radiofrequency signals travelling through the slots **331**. The pivoting support **310** may be cylindrical and formed of a material which is transparent to radiofrequency signals.

The antenna **300** takes at least two configurations, a first configuration, illustrated in FIG. **3***a*, in which the dipoles are oriented in a first direction, and a second configuration, illustrated in FIG. **3***b*, in which the dipoles are oriented in a second direction. The two configurations of the antenna **300** correspond to different polarizations.

The orientation of dipoles disposed in a row is controlled by a rack **340** placed along this row. For example, a row **350** comprising pivoting supports **310** placed above different waveguides **303***a*, **303***b*, **303***c* is controlled by a rack adjoining the pivoting supports and comprising notches at least at the level of the pivoting supports **310**. The pivoting supports **310**, in the example cylindrical, comprise striations on their wall, so that when the rack **340** is displaced according to a translational motion along the row **350**, it drives the pivoting supports **310** in rotation, and consequently the dipoles **320** which are fixed thereto. A different rack may be assigned to each row of dipoles, in such a way that drive means drive the translation of all the said racks, so as to rotate all the pivoting supports and thus modify the polarization configuration of the antenna. Advantageously, the antenna **300** is configured so that the translations of racks **340** correspond to a rotation of half a turn of the pivoting supports **310**.

According to another embodiment of the antenna, the rack **340** is replaced with a rod pressed against the pivoting supports **310**, the said rod having capabilities for adhering to the pivoting supports **310**, the said rod and the said pivoting supports being for example formed of a rubbery material.

FIGS. **4***a*, **4***b* and **4***c* present a third embodiment of the antenna according to the invention. The antenna **400** comprises a flexible band **401** comprising two separate parts **411**, **412**. The first part **411** and the second part comprise dipoles **420** in equal numbers in the two parts **411**, **412**. The dipoles **420** of the second part **412** are placed in such a way that their respective centres of gravity could be superimposed on the centres of gravity of the dipoles **420** of the first part **411**. The orientations of the dipoles are identical within one and the same part **411**, **412**, but are different from one part to the other.

The antenna **400** also comprises a set of waveguides comprising apertures in the form of slots **431**, as well as drive means for the flexible band **401** so as to place this flexible band **401** above the slots **431** while matching up the positions of the dipoles **420** and the positions of the slots **431**. The drive means can comprise two rollers **440** (FIG. **4***c* presents the antenna viewed from the top) placed facing one another so as to wind up or unwind the flexible band **401** above the waveguides. The two rollers **440** may be placed on edges of the antenna **400**, similarly to the disposition of the brackets (cf. FIG. **2***a*) in the first embodiment described above.

According to a first configuration of the antenna **400**, the rollers **440** are activated so as to place the first part **411** above the slots **431**, in order to generate a first antenna polarization. According to a second configuration of the antenna **400**, the rollers **440** are activated so as to place the second part **412** above the slots **431**, in order to generate a second antenna polarization.

The antenna switching can thus be triggered by the motorized activation of the rollers in one direction or in the other, so as to modify the orientation of the dipoles illuminated by the radiofrequency signals travelling through the slots of the waveguides.

An advantage of the antenna according to the invention is that it does not impose any distance between the slots, thereby making it possible to densify the array of radiating elements and thus to obtain a directional radiation pattern.

The invention claimed is:

1. An antenna with polarization switching comprising:

a plurality of waveguides fed with radiofrequency signals and perforated with apertures, the apertures being disposed to illuminate radiating elements placed on support means in a plane that is distant from the apertures, the support means being configured to switch between at least a first and a second configuration,

wherein in the first configuration adjacent radiating elements are illuminated and oriented along a first direction with respect to the apertures, and in the second configuration adjacent radiating elements are illuminated and oriented along a second direction, different from the first direction, with respect to the apertures.

2. The antenna with polarization switching according to claim **1**, wherein the radiating elements illuminated according to the first configuration and the radiating elements illuminated according to the second configuration are the same, and wherein the support means is adapted to modify the orientation of the radiating elements with respect to the apertures.

3. The antenna with polarization switching according to claim **1**, wherein the waveguides are rectangular cross-section guides, the apertures being distributed, for each of the waveguides, on a face of the waveguide alternately on either side of a longitudinal mid-axis of the waveguides.

4. The antenna with polarization switching according to claim **1**, wherein the apertures are slots.

5. The antenna with polarization switching according to claim **4**, wherein the slots are parallel to a longitudinal axis of the waveguides.

6. The antenna with polarization switching according to claim **1**, wherein the radiating elements are dipoles.

7. The antenna with polarization switching according to claim **1**, wherein the radiating elements are placed above the apertures at a height comprised between a fifth and a quarter of the wavelength of the radiofrequency signals travelling in the waveguides.

8. The antenna with polarization switching according to claim **1**, wherein the support means of the radiating elements are constructed of a material which is transparent to radiofrequency waves.

9. The antenna with polarization switching according to claim **1**, wherein the support means of the radiating elements comprise several parallel strips maintained above the apertures, it being possible for the strips to be arranged according to at least the first configuration and the second configuration, the strips being able to invert so as to place a first face of the strips facing the apertures in the first configuration, and the opposite face of the strips facing the apertures in the second configuration.

10. The antenna with polarization switching according to claim **9**, wherein the radiating elements form a nonzero and non-orthogonal angle with a longitudinal axis of the strips, the strips being able to rotate about the longitudinal axis in order to invert.

11. The antenna with polarization switching according to claim **1**, wherein the support means of the radiating elements comprise pivoting elements aligned according to several rows, the support means comprising, for each of the rows, a rod adjoining the pivoting elements of the row, the rod and the pivoting elements being configured in such a way that a translational motion of the rod drives the pivoting elements in rotation.

12. The antenna with polarization switching according to claim **1**, wherein the support means of the radiating elements comprise rollers and a flexible band arranged so as to be able to wind up around the rollers, the flexible band comprising a first part on which are fixed adjacent radiating elements oriented in a first direction, and a second part on which are fixed adjacent radiating elements oriented in a different direction from the first direction.

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